

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Amendment of Part 90 of the Commission's Rules))	WP Docket No. 07-100
)	
Implementing a Nationwide, Broadband,)	PS Docket No. 06-229
Interoperable Public Safety Network in the 700)	
MHz Band)	
)	
Service Rules for the 698-746, 747-762 and 777-)	WT Docket No. 06-150
792 MHz Bands)	

To: The Commission

**COMMENTS OF
SPECTRUM BRIDGE, INC.**

Executive Summary

Spectrum Bridge, Inc. ("Spectrum Bridge") applauds the FCC goal to develop rules for viable commercial use of the 4940-4990 MHz band on a shared basis with public safety licensees that will promote increased use of the band for new broadband services, while ensuring that public safety licensees do not experience harmful interference. Further promoting innovation in this band will result in new technologies and more competitive offerings for the Public Safety community.

In this document Spectrum Bridge describes proposed solutions and strategies that support the Fifth Further Notice of Proposed Rulemaking for 4.9 GHz.

Specifically, the solutions and strategy discussed herein support the Commission's efforts and desires to spur robust and efficient use of this band through new approaches to spectrum sharing and frequency coordination/management. These recommendations are based on Spectrum Bridge's experience developing and deploying its Authorized Shared Access platform (ASA) that currently supports secondary spectrum use (spectrum sharing) in the 5 GHz UNII band and VHF/UHF TV bands, as well as operating a secondary market place for spectrum (SpecEx).

Spectrum Bridge's ASA platform includes the basic components necessary to implement the solutions proposed in this Report and Order. As such, we purport

that the technology to support the vision exists and further propose that a trial be immediately commenced in a test market to address the concerns of Public Safety entities related to interference and congestion and to stimulate an appropriate level of public/private partnerships. Furthermore, we expect such a trial to result in the identification of additional benefits to the Public Safety community. In the case of TV White Space, there have been numerous unexpected benefits to incumbent operators, and we expect this to be replicated within the Public Safety Community.

This response describes two distinct forms of spectrum sharing with the view that either, or both, could be adopted in the 4.9 GHz band, though the focus is on the more strictly controlled Secondary Use. Both the “Secondary Use” concept and the “General Authorized Use” concepts could be used for additional Public Safety sharing of the band. In addition this response argues that using a database approach to managing the access and use of spectrum will be more efficient than the current process of coordination.

This response and the associated solutions include the core capabilities discussed in the PCAST report¹ pertaining to spectrum sharing. The entire Test/Trial solution can be deployed, operated and managed by Spectrum Bridge, however the architecture allows for a division of responsibilities where privacy or controls may be necessary in a post trial deployment.

¹ Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth. President’s Council of Advisors on Science and Technology, July 2012.

Table of Contents

Section 1. Public Safety Spectrum Database and Policy Driven Sharing.....	5
Section 2. Public Safety Incumbent and Protected Entity Registration Process.....	8
2.1 Permanent Registrations.....	9
2.2 Temporary Registrations.....	10
2.3 Coordination of Registrations.....	11
Section 3. Secondary Use of the 4.9 GHz Band.....	12
Section 4. General Authorized (Unlicensed) Access to 4.9 GHz Spectrum.....	15
Section 5. Test Bed and Trial.....	17
Conclusion.....	19

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To: The Commission

**COMMENTS OF
SPECTRUM BRIDGE, INC.**

Spectrum Bridge, Inc. ("Spectrum Bridge") hereby submits its Comments in the above-referenced proceeding.² Spectrum Bridge describes proposed solutions and strategies that support spectrum sharing in the 4.9 GHz band. As further described below, Spectrum Bridge proposes solutions to support the Commission's efforts and desires to spur robust and efficient use of this band through new approaches to spectrum sharing and frequency coordination/management. These recommendations are based on Spectrum Bridge's experience developing and deploying its Authorized Shared Access platform (ASA) that currently supports

² *Amendment of Part 90 of the Commission's Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, Fourth Report and Order and Fifth Further Notice of Proposed Rulemaking, WP Docket No. 07-100, PS Docket No. 06-229 and WT Docket No. 06-150, FCC 12-61, rel. June 13, 2012 ("FNPRM").

secondary spectrum use (spectrum sharing) in the 5 GHz UNII band and VHF/UHF TV bands, as well as operating a secondary market place for spectrum (SpecEx).

The solution is described in sections, as follows:

Section 1: A database provisioned with the rules and regulations associated with the 4.9 GHz spectrum, including upper and lower frequency ranges, channel structure, permissible use, authorized users, propagation models, service and interference thresholds and underlying terrain data.

Section 2: A comprehensive registration system for all existing Public Safety agencies. Similar to TVWS, the system would accommodate permanent reservations for specific frequency/location/times as well as temporary or immediate reservations to support incidents exactly when and where they occur.

Section 3: A mechanism for Secondary Access to, or leasing of unused spectrum. This includes mechanisms to control and manage access, ensuring that only those approved entities are granted access rights.

Section 4: A General Authorized Access (unlicensed access) management system, similar to the system used for TV White Space to allow Part 15 unlicensed devices to use spectrum not allocated/used for primary or secondary use. As proposed this could be restricted to entities related to Public Safety rather than the general population.

Section 5: A test bed architecture and test market objectives. The test bed would be designed to validate the protection criteria and capability and to identify refinements, where appropriate.

1. Public Safety Spectrum Database and Policy Driven Sharing

Spectrum Bridge has developed a spectrum sharing and spectrum management solution described as ASA. ASA includes high fidelity terrain databases, propagation models, databases of network elements, policy and rules engines³ and an intuitive set of user interfaces and tools to configure and access the system. Today ASA supports spectrum sharing and management in two bands: the 5

³ Based on 47 C.F.R. Part 90 and the *FNPRM*.

GHz UNII band (shared with FAA TDWR) and the VHF/UHF TV bands for unlicensed operation. In addition, ASA provides the foundation for a secondary marketplace for spectrum - SpecEx.

A platform such as ASA can easily be expanded to support the protection of Public Safety (incumbent) operations in the 4.9 GHz band. For the purpose of illustration, the ASA platform is used as an example implementation of a 4.9 GHz spectrum sharing solution.

The ASA platform can facilitate coordination efforts to better utilize the 4.9 GHz band in several ways. Some of these capabilities are described in this response but the platform is flexible and agile enough to support other coordination tools and hierarchies used by Public Safety Agencies. An example of the power and flexibility of a network based management solution is the ease and speed of the TVWS solution to be updated in response to updates and amendments to the FCC TVWS rules over the last two years.

If Spectrum Bridge were to host and manage the proposed basic registration and protection database, using the ASA platform on behalf of the FCC and public safety agencies, it would be at low cost or no charge to the FCC or the Public Safety agencies.

In the first phase, a “registration” process for Public Safety operations is executed with emphasis on the protection of incumbent operations with priority over, and protection from, secondary and unlicensed users.

Registration is considered for two types of Public Safety entities, permanent and temporary (incident related). The database can be populated with registrations of incumbent operations, restricting secondary and unlicensed users (Figure 1). These registrations can be searched and displayed in a number of different formats. Various examples of search and display capability are exemplified in our TV White Space solution (www.showmywhitespace.com). FCC rules require that all TV White Space data be publicly available. In the case of the 4.9 GHz band, this information may be restricted or may require authorized credentials to gain access. These display tools also provide the basis for coordination capabilities between agencies. As previously stated SBI Believes that experience in TVWS management has demonstrated that a database approach is a significant improvement over existing Public Safety Coordination methods.

Once a registration is complete, it results in record(s) with frequency (channel), location and duration of use. The registration data also includes information about the registrant including contact information. Should another registration be made in the same geographic area, the system automatically informs existing registrants of the new record. This simple step automates the monitoring process and ensures that all constituents are aware of updates and changes in the band.

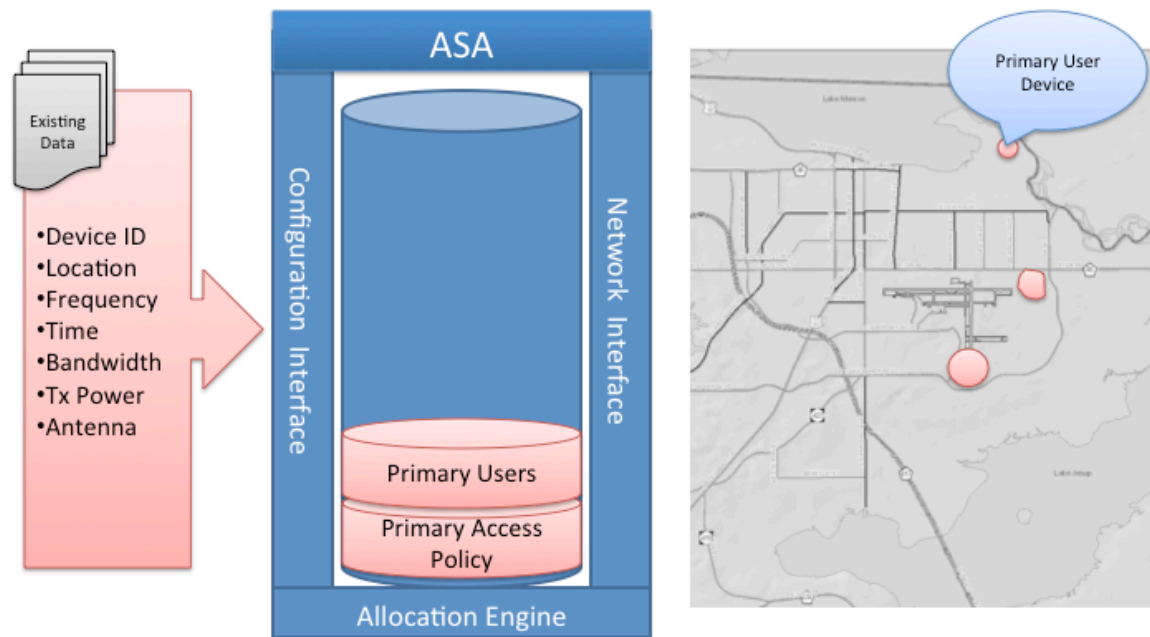


Figure 1

The same tool also provides information to a new registrant about pre-existing registrations. These steps greatly improve the efficiency of coordination. Furthermore, the ASA platform includes information and tools that can assist in the planning, management, and coordination of complex frequency planning scenarios. In addition to the graphical representation and registration information, the platform includes the capability to plot the coverage of registered users, employing user selected propagation models.

After the database has been configured with all relevant data describing public safety operations, it can facilitate the availability of unused spectrum on a secondary and/or unlicensed basis. The ASA platform includes an integrated toolset that allows data to be audited, analyzed and updated to ensure it is current and accurate.

2. Public Safety Incumbent and Protected Entity Registration Process

The ASA platform supports two forms of protection for public safety entities. Each has different implications on the use of spectrum by secondary and unlicensed users.

The registration process is highly flexible in terms of frequency, time and location, or operating area. Recurring or repeating events can also be registered (for example: every Friday at 17:00).

The registration process is an integrated component of the ASA platform and can be managed and supported by Spectrum Bridge on behalf of the Public Safety community. Management by an independent 3rd party can be viewed as one way to deal with conflicts of interest and priority, which can be mitigated via predefined rules or agreements. Management and allocation of unused spectrum is further described in Sections 3 and 4.

2.1 Permanent Registrations

In the White Space implementation of ASA, permanent registrations are derived from one of two sources. The first is license data extracted directly from the FCC (e.g. CDBS and ULS). This is an option for the 4.9 GHz band, should the rules result in a more formal and/or descriptive licensing of Public Safety spectrum. The second source is the Protected Entity Registration Process (see <http://whitespaces.spectrumbridge.com/Main.aspx>) in which incumbents are permitted to register a variety of applications and services for protection. In the latter case, eligibility is verified against the base license information extracted from

the FCC records. The actual protection criteria are determined by the rules and the information is provided by the FCC and in the registration record. A similar process can be implemented for the 4.9 GHz band.

Registrations would be stored within the ASA platform with the ability to update and delete registrations, as required. The flexibility of the ASA platform further allows for a high degree of customization and management. For example, a registration could have a defined expiration date (with or without automated reminders). In addition, the process is secure, incorporating account based (user name/password) access. The system can also accommodate User Groups and other associations of similarity based on geography, application/service type or device type.

2.2 Temporary Registrations

Within the ASA platform, temporary registrations are typically associated with an incident. That is they are triggered by potentially random events, and can require registrations at any time, in any location, but may only last for a short period of time. Temporary events or incidents may also be known or planned in advance, so a pre-registration process is also supported by this platform.

An incident is defined primarily by location and the ASA platform provides two simple mechanisms to define geography. The first is a point with a fixed radius or contour defined by a propagation model, similar to the FCC site-based licensing model. The second is a user-defined polygon or shape file, similar the concept of market based licensing. For Public Safety users operating in the 4.9 GHz band this process can be designed to be extremely efficient, which may result in alternative

methods of defining geography, such as free-hand map entry. The goal is to enable an authorized Public Safety entity to declare and define an incident as quickly as possible to ensure appropriate access to the spectrum is achieved within seconds or minutes. This time frame is believed to be a reasonable and practical means to facilitate sharing. The implications and practicalities of a faster or slower registration process can be investigated in a trial.

Record Identification	Fixed	System identity
Record Tag	Optional	User defined label, example: incident name
Registration type	Mandatory	Defines the type of protection
Location	Fixed	Lat/Long, either input by user or derived from address
Address	Optional	Street address
Site name	Optional	Building name or location identifier example "Pier 38"
Contact Name	Mandatory	Who is responsible for registration
Contact information	Mandatory	Address, phone, email
Equipment ID	Mandatory	FCC ID
Max Power	Mandatory	
Fixed or Mobile	Mandatory	
Antenna	Mandatory	Antenna type and HAAT

Table 1 - Exemplary Registration Data Set

2.3 Coordination of Registrations

As mentioned in Section 1, the ASA platform provides comprehensive information and tools to support a coordinated registration process. The platform also has the capability to facilitate a coordination role and Spectrum Bridge is willing and able to provide this additional service on behalf of the Public Safety

Community. However, as the roles and responsibilities of various entities are not defined at this time, it is not possible to fully describe how this service would be implemented.

Spectrum Bridge is also willing to license the ASA platform to a Public Safety agency such as the National Regional Planning Council (NRPC), and develop the tools and train the agency so they can perform the coordination activities. Because similar capabilities are inherent in the underlying ASA platform, these services will be less complex and less expensive to implement and manage than alternatives that rely on existing Part 101 and Part 90 coordination schemes.

Scalability is inherent. The TV White Space database efficiently tracks over 12,000 individual and unique incumbent licenses, registrations and protected entities⁴ at any given time and is designed to support many more.

Regardless of whether Spectrum Bridge, a Public Safety Agency or combination of entities manage the registration process, it is critical that the registration process component of the solution be a standalone entity (not a government managed system). This is the only way to cost effectively and accurately share the solutions described in sections 3 and 4.

3. Secondary Use of the 4.9 GHz Band

This section addresses the questions in the NPRM related to “Expanded Eligibility and Alternate Licensing”. This concept of secondary access is defined as “short term priority operating rights in a specified geographic area that provides

⁴ On September 24th the actual number of entities was 12,200

interference protection from opportunistic use because of payments”. Short-term can be defined in intervals from minutes to days, per regulation.

In the context of this response we do not propose whether payment should be required, who should receive payment or what form a payment should be. However, we describe how the ASA platform facilitates the capability to implement and support various remuneration schemes. The ASA platform can provide a number of flexible approaches to sharing, including pre-emption, but Spectrum Bridge believes that the pre-emption should not be absolute (mandatory shut down) if this form of secondary use is to be viable. Consider the analogy of a fire truck having priority, but not exclusive access to a highway in an emergency. The ASA platform is capable of implementing and policing a similar scheme in support of secondary use of the 4.9 GHz band. Obviously, if the sharing scheme is attractive enough to encourage “paying” users, revenue opportunities can become significant.

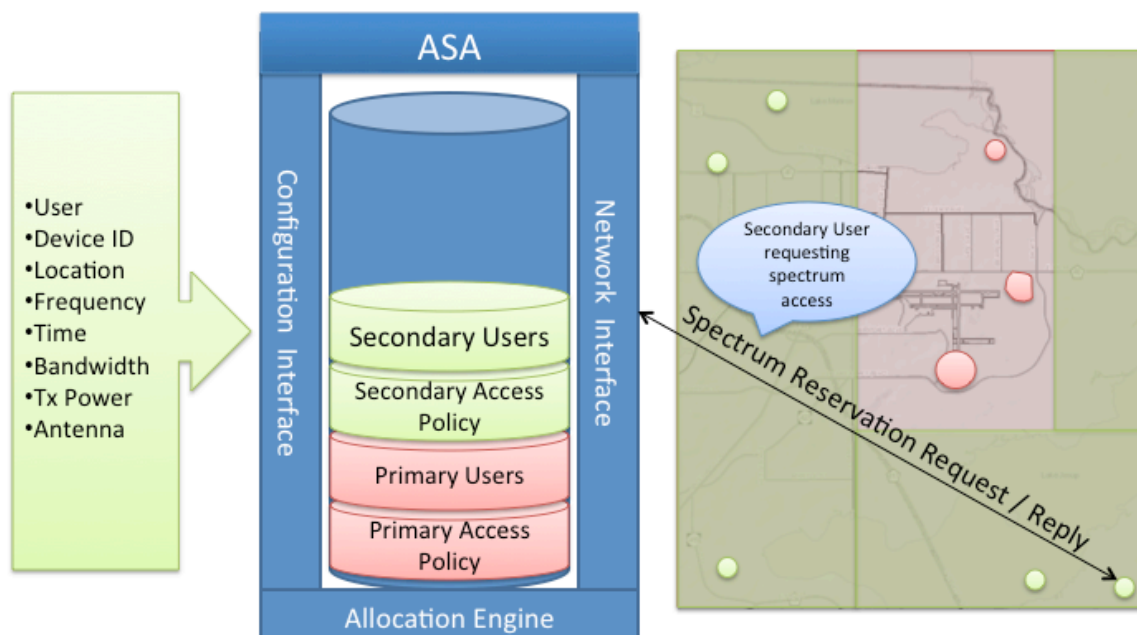


Figure 2 - Enabling Secondary Access

Figure 2 depicts how Secondary access is integrated with incumbent protection within ASA. The platform is aware of what spectrum is available for secondary use and allocates it on a first-come first-served basis.⁵ Included in the reservation process is validation/authentication process of the requesting party, which in turn provides the billing/clearing house information, along with information about the requested location. FCC rules and Public Safety Operating parameters will dictate the amount of acceptable interference that can be tolerated and what permissions for secondary use will be allowed. The ASA platform implements and applies these rules. Today TV White Space is allocated based on fixed “separations” from incumbent operations. Similar methods can be adopted for the 4.9 GHz band. However other mechanisms are also effective and supported by the ASA platform. One of the most effective methods is to use a maximum operating power constraint rather than a fixed separation distance. In this case the ASA platform will calculate the maximum power that a secondary user can utilize without causing interference to incumbent operations in the area.

The ASA platform has the ability to facilitate reservations in the future. This would permit an event organizer to reserve spectrum in support of an event, a priori. For instance planning a communication system for a Sporting Event or a Concert. This is an example in which an entity might provide compensation for exclusive or deterministic access to spectrum as opposed to utilizing the unlicensed use described in section 4.

⁵ This assumes all secondary users are equal but the platform is capable of supporting priority or hierarchical secondary access if required.

The operation of the ASA platform implements secondary use in two parts. The first part is the registration/validation and permission to use spectrum, including optional clearinghouse functions. This first part may be executed by a network operator via a User Interface/API or via a M2M interface to the platform. The second part is entirely automated to support pre-emption. Each registered radio device will query the platform at a specified interval and receive authorization to use the spectrum. In normal situations a user will receive authorization to use all available spectrum. In the case of a local incident or other pre-emptive activity, a Public Safety entity may need specific spectrum and remove some spectrum from the available pool. As previously mentioned, the specific implementation is a function of configurable policy(s) and the ASA platform would simply manage authorization(s) based on the provisioned policy(s). Note that the pre-emption model proposed for secondary use is different from the model proposed for unlicensed use described in section 4.

4. General Authorized (Unlicensed) Access to 4.9 GHz Spectrum

As noted by the Commission, the 4.9 GHz band is adjacent to the 5 GHz band used for unlicensed Wi-Fi (802.11). With the advent of the new 5G (Gigabit) 802.11ac standard, the need for much wider channels is critical. Opening up the 4.9 GHz band on an unlicensed, but pre-emptive basis would be very useful as a means to adopt these new technologies.

As shown in figure 3, unlicensed users would have a lower priority than both incumbent Public Safety use and the Secondary users of the spectrum in any given

location. Therefore, only spectrum that is not used by either is available for unlicensed use. Unlicensed use does not have to mean uncontrolled or unmanaged use. While the traditional concept of General Authorized or Unlicensed Access is for consumer use of a band, in this case access is controlled by the ASA system. Thus unlicensed use could be made available in a controlled and managed format for a predefined community. For instance devices operated by local government agencies or utilities may be the only devices permitted to operate in this mode.

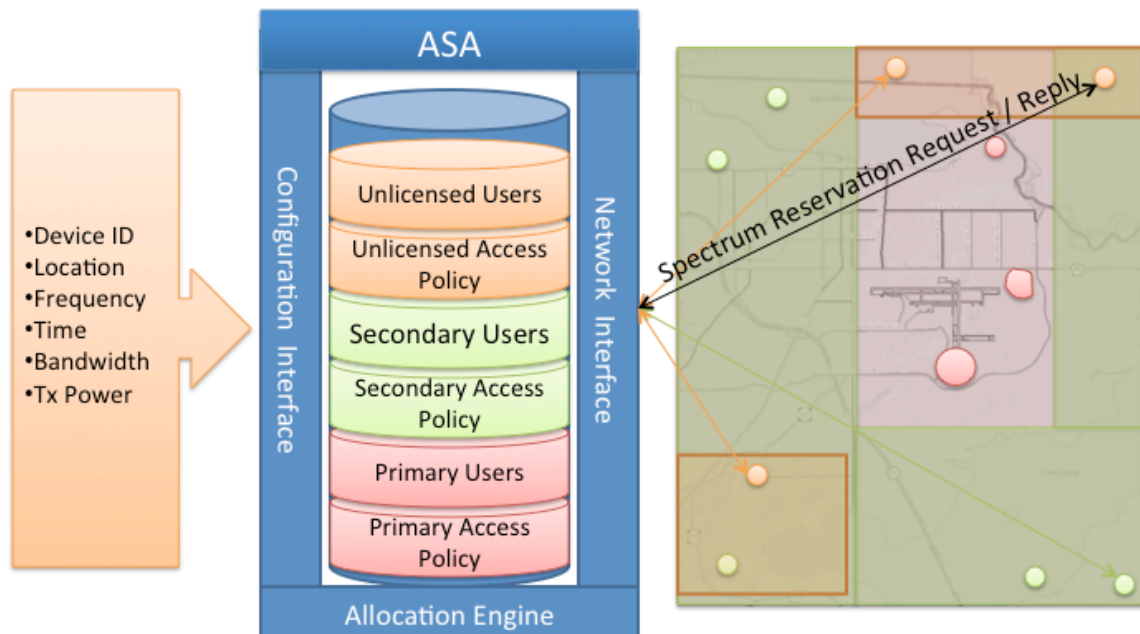


Figure 3 - Unlicensed Access

Unlicensed operation is supported in exactly the same way that TV White Space access is supported. There is a M2M interface between the unlicensed wireless device and the ASA platform, which is fully automated and requires no human interaction.

Unlicensed radios are equipped with an integrated geo-location capability and be able to query the ASA platform via the Internet, while providing information

that describing their location and the device type. Based on this information, the platform can return a list of available spectrum. Concurrent with a secondary use model, the allowance would be made for a pre-determined lease time (e.g. 5 minutes). After the specified interval, the device would either cease operation or request a new lease from the ASA platform.

Pre-emption of unlicensed devices is proposed as a “shut down” operation, although the process could use other techniques, if desired. Once a Public Safety entity defines an incident (Figure 4), unlicensed devices would lose the ability to use affected spectrum until the incident is terminated. In practice, this means that Public Safety entities would be able to clear the unlicensed users out of an incident location in a very short time (seconds to minutes).

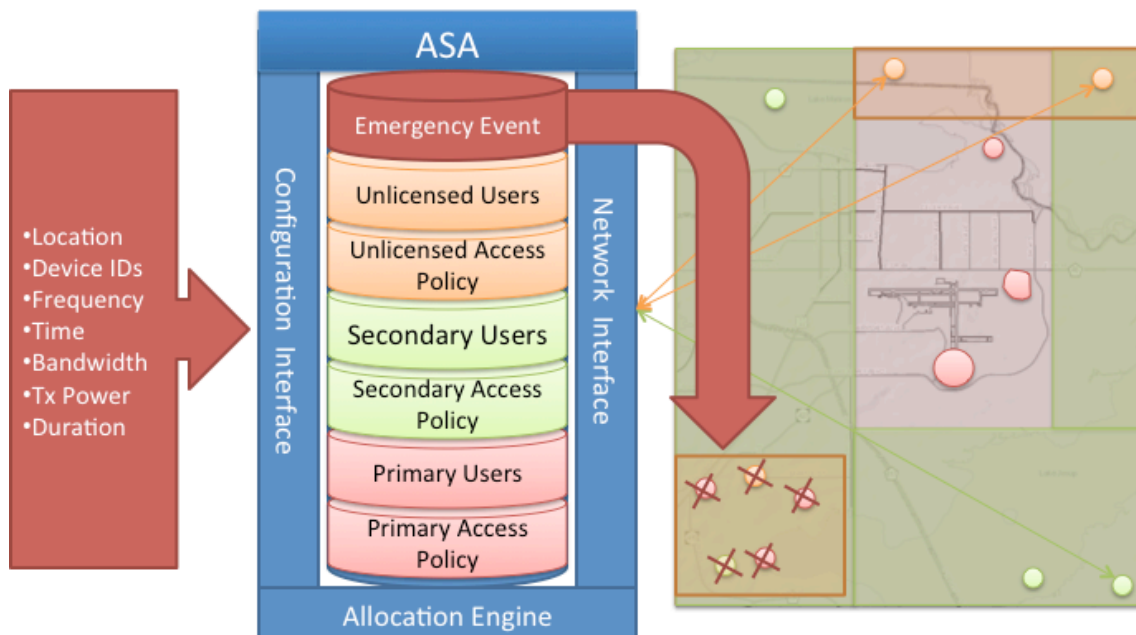


Figure 5 - Pre-emption

5. Test Bed and Trial

As described above, there are no significant technology barriers to implement a solution that can manage and coordinate Public Safety use of the 4.9 GHz band and further provide a variety of secondary and unlicensed access schemes to allow access to unused bandwidth. However, there are a number of questions that remain related to the definition of optimal operating characteristics and how to manage the process.

There is also skepticism that such a system can effectively manage spectrum in this band or if it is an appropriate use of technology like ASA. Similar fears and concerns existed in the TV bands, however most concerns have been allayed as trial networks and commercial solutions were implemented and deployed. The close cooperation of the ecosystem members, through FCC workshops while evaluating the rules and the solutions, was a significant benefit in this process. Spectrum Bridge recommends that various ecosystem constituents implement a realistic market trial to address questions and concerns with the goal of further defining a set of. Furthermore, we expect this can be accomplished in a shorter time frame by leveraging existing experience, the mature nature of database technology and the availability of COTS radios for the 4.9 GHz band.

By working cooperatively with the public safety community, we hope to learn more about the use cases, needs and desires of public safety users, as well as share perspectives on database use and reliability. This will ultimately promote responsible spectrum sharing and lead to expeditious adoption of consensus-driven rules.

The JOBS act allocated significant funds for Public Safety Research and Development into these issues. In practice only a small fraction of those funds would be required to develop and deploy a test bed that would have the following objectives.

- Validate the ability of a Geo-location database to identify and protect all incumbent operations
- Validate that the Spectrum Management system could permit sharing without undue or unreasonable interference to incumbent operations
- Determine the mechanisms and timings required to provide adequate priority to Public Safety entities at an incident.
- Provide input to a new FCC rule making to permit sharing of the 4.9 GHz band

Conclusion

Spectrum Bridge believes that promoting spectrum sharing innovation in the 4.9 GHz band will result in new technologies and more competitive offerings for the Public Safety community. Adopting both Primary Use and Secondary Use concepts protects incumbents while promoting an open commercial platform for broader access and more efficient utilization of the spectrum. Furthermore, the use of a database to managing the access and use of spectrum will be more effective than the current process of coordination (as proven in the TV White space implementation). The technology exists to support this vision and recommend moving forward immediately with a test market to establish policy and address the concerns of Public Safety entities related to interference and congestion.

Spectrum Bridge is available to address questions or requests for additional detail from the Commission. Please contact the undersigned directly.

Respectfully submitted,

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